U.S. DEPARTMENT OF COMMERCE
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PB-260 322

SUMMARY REPORT ON QUALITY OF INTERSTATE WATERS

RED RIVER OF THE NORTH

(MINNESOTA-NORTH DAKOTA-SOUTH DAKOTA)

PUBLIC HEALTH SERVICE, WASHINGTON, D.C.

OCTOBER 1960

287013

PB 260 322

NTIS 1/74
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SUMMARY REPORT ON QUALITY OF INTERSTATE WATERS: RED RIVER OF THE NORTH (MINNESOTA-NORTH DAKOTA-SOUTH DAKOTA)

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SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No. PB-260 322
4. Title and Subtitle Summary Report on Quality of Interstate Waters: Red River of the North (Minnesota-North Dakota-South Dakota)			5. Report Date Oct 60 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Public Health Service, Washington, D. C.			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts

Water quality of the Red River and its tributaries in Minnesota, North Dakota, and South Dakota was examined. Tabular data are provided on: sources of pollution (municipal and industrial), stream flow, interference with water uses, adequacy of treatment measures, action of official agencies, Public Health Service grants for construction of waste treatment facilities, nature of delays in abating pollution, and time schedule for proposed remedial action. Laboratory data are included.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

*Water quality
*Water pollution sampling
Tables(Data)
Red River
Minnesota
North Dakota
South Dakota
Water supply
State agencies
Construction
Water pollution control equipment
Municipalities
Industrial wastes
Waste disposal

17c. COSATI Field/Group 13B

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 33
	20. Security Class (This Page UNCLASSIFIED	22. Price

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

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SUMMARY REPORT ON QUALITY OF INTERSTATE WATERS

RED RIVER OF THE NORTH

(MINNESOTA-NORTH DAKOTA-SOUTH DAKOTA)

This report, one of a series developed by the Public Health Service, is a factual presentation of conditions which exist in a specific location or area, based on data and information furnished by State, Interstate and Federal agencies concerned. This report is a brief summary of such material in the files of the Public Health Service as of the time the report is issued. The report will be revised from time to time to reflect new information and changing conditions.

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

October 1960

SUMMARY REPORT ON QUALITY OF INTERSTATE WATERS

RED RIVER OF THE NORTH

(MINNESOTA-NORTH DAKOTA-SOUTH DAKOTA)

(Data Current to October 1, 1960)

I. LOCATION

The Red River of the North is formed by the union of the Ottertail and the Bois de Sioux Rivers at the twin cities of Wahpeton, North Dakota and Breckenridge, Minnesota (river mile 394).* Lake Traverse, headwaters of the Bois de Sioux, and a short stretch of this river form part of the boundary between South Dakota and Minnesota. The Bois de Sioux and Red Rivers form the State Boundary between North Dakota and Minnesota.

Once the bed of a glacial lake, the Red River Valley is a broad, level plain varying in width from 15 to 70 miles and sloping almost imperceptibly toward the north. Major tributaries to the River other than those already mentioned are: Sheyenne River (mile 273) and Red Lake River (mile 143).

Agriculture and related activities are the principal sources of livelihood. Of some 220 municipalities, some ten have populations in excess of 5,000. Most communities have less than 500 inhabitants. The total population of the Basin is about 490,000. The four largest municipalities are Moorhead, Minnesota (14,870 population), Fergus Falls, Minnesota (12,917), Fargo, North Dakota (38,256), and Grand Forks, North Dakota (26,836).

II. SOURCES OF POLLUTION

At present, the major contributors to interstate pollution are the municipalities of Grand Forks and Fargo in North Dakota. Several beet sugar processing industries listed in Table I are also large contributors.

* All river mileages in this report are projected from the Canadian Boundary rather than from the mouth of the Red River.

TABLE NO. 1 - BASIC DATA ON SOURCES OF POLLUTION [1/]

Municipality or Industry	River Miles to Canadian Border	Sewered Population	P. E. Waste Before Treatment	Nature of Wastes	Treatment Provided	P. E. Discharge to Watercourse
Red River of the North						
Bois de Sioux River	394					
Mustinka River	394-42					
Five Mile Creek	394-42-17					
Herman, Minn.	394-42-17-17	640	780	Municipal	None	780
Twelve Mile Creek	394-42-17					
Donnelly, Minn.	394-42-17-38	345	780	Municipal Industrial	None	780
West Branch	394-42-17-12					
Graceville, Minn.	394-42-17-12-23	920	790	Municipal	Primary	550
Fairmount, N.D.	394-18	620	1,000	Municipal	None	1,000
Ottertail River	394					
Frazee, Minn.	394-147	1,050	2,520	Municipal Industrial	Primary	1,760
Frazee Cream Co.			610	Organic	None	610
Fergus Falls, Minn.	394-50	9,800	20,730	Municipal Industrial	Primary [2/]	13,100
Pelican River	394-46					
Pelican Rapids Minn.	394-46-23					
Farmers Coop. Creamery Assoc.			1,000	Organic	None	1,000
Red River of the North						
Wolverton, Minn.	348	200	360	Municipal	Primary	250

Municipality or Industry	River Miles to Canadian Border	Sewered Population	P. E. Waste Before Treatment	Nature of Wastes	Treatment Provided	P. E. Discharge to Watercourse
Wild Rice River	315					
Forman, N.D.	315-115	400	400	Municipal	Septic tank	280
Lidgerwood, N.D.	315-109	1,100	1,100	Municipal	Septic tank	1,000
Red River of the North						
Fargo, N.D.	286	40,000	48,700	Municipal	Secondary	20,000
Sheyenne River	273					
Anamoose, N.D.	273-518	500	900	Municipal	Land application	900
Harvey, N.D.	273-462	2,000	2,500	Municipal	None	2,500
McVille, N.D.	273-348	500	800	Municipal	Septic tank	800
Cooperstown, N.D.	273-325	800	1,060	Municipal	Septic tank	830
Bald Hill Creek	273-276					
Wimbledon, N.D.	273-276-29	350	600	Municipal	Septic tank	500
Maple River	273-20					
Enderlin, N.D.	273-20-52	1,400	1,400	Municipal	Septic tank	1,200
Swan Creek	273-20-21					
Casselton, N.D.	273-20-21-9	950	1,800	Municipal	Septic tank	1,620
Buffalo River	263					
Callaway, Minn.	263-72	225	280	Municipal	Primary	190
Hawley, Minn.	263-43	1,000	2,980	Municipal Industrial	None 2/	2,980
Minnesota Wild Rice River	225					
Mahonomen, Minn.	225-106	1,400	1,620	Municipal	None	1,620
Twin Valley, Minn.	225-69	760	830	Municipal	None	830

Municipality or Industry	River Miles to Canadian Border	Sewered Population	P. E. Waste Before Treatment	Nature of Wastes	Treatment Provided	P. E. Discharge to Watercourse
South Branch	225-21					
Omega, Minn.	225-21-105					
Omega Creamery	225-21		670	Organic	None	670
Red River of the North						
Halstad, Minn.	220	570	720	Municipal	None	720
Goose River	203					
South Branches	203-84					
Finley, N.D.	203-84-41	640	940	Municipal	Primary	770
Goose River	203					
Mayville, N.D.	203-60	1,500	2,000	Municipal	Primary	1,700
Sandhill River	187					
Fertile, Minn.	187-36	820	2,900	Municipal Industrial	None	2,900
Climax, Minn.	187-15	100	100	Municipal	None	100
Red Lake River	143					
Battle River	143-195					
Northome, Minn.	143-195-41	140	200	Municipal	Primary	140
Kelliher, Minn.	143-195-33	180	240	Municipal	Primary	170
Clearwater River	143-91					
Red Lake Falls, Minn.	143-91-2	1,380	1,790	Municipal	Primary	1,260
Red River of the North						
East Grand Forks, Minn.	142	3,150	Undet.	Municipal Industrial	Secondary	Undet.
American Crystal Sugar Co. 4/			105,000	Organic	Sedimentation 3/	63,000

Municipality or Industry	River Miles to Canadian Border	Sewered Population	P. E. Waste Before Treatment	Nature of Wastes	Treatment Provided	P. E. Discharge to Water course
Grand Forks, N.D.	141	28,000	32,850	Municipal	Primary	24,000
N. D. Mill & Elevator			2,500	Organic	None	2,500
Meat Service Co.			600	Organic	Septic tank	250
Snake River	75					
Middle River	75-6					
Argyle, Minn.	75-6-15	900	1.050	Municipal	None	1,050
Park River	67					
Grafton, N.D.	67-30	4,700	Undet.	Municipal Industrial	Lagoon	Undet.
Tamarack River	65					
Stephen, Minn.	65-16	600	1,080	Municipal	Primary	860
Red River of the North						
Drayton, N.D.	53	850	950	Municipal	None	950
Drayton Creamery			640	Organic	Septic tank	540
Nameless Creek	32					
Kennedy, Minn.	32-18	300	290	Municipal	None	290
Two Rivers	20					
North Fork	20-4					
Lancaster, Minn.	20-4-24	400	390	Municipal	Primary	270
Pembina River	3					
Walhalla, N.D.	3-90	1,000	1,100	Municipal	None	1,100

1/ Data from PHS Publication No. 622 or PHS Region VI files.
2/ New secondary treatment plant under construction.
3/ This is retention pond treatment which permits regulated discharge as approved by the Minnesota Department of Health.
4/ Seasonal industry.

To date, discharges to the Red River of the North from the sources of pollution in Minnesota and North Dakota have continued as indicated above.

TABLE NO. 2 - STREAM FLOW DATA IN cfs

No. and Location of Gaging Station	Years of Record	Average	Maximum	Minimum
Ottertail River near Detroit Lakes, Minn.	19	53.5	371	0.1
Pelican River near Fergus Falls, Minn.	16	70.6	756	0
Ottertail River near Fergus Falls, Minn.	24	529	1,710	1.0
Mustinka River above Wheaton, Minn.	24	49.5	7,320	0
Bois de Sioux River near White Rock, S.D.	15	86.5	1,410	0
Red River of the North near Wahpeton, N.D.	13	549	7,130	40
Wild Rice River near Abercrombie, N.D.	20	71.8	5,500	0
Red River of the North at Fargo, N.D.	55	492	16,300	0
Sheyenne River near Harvey, N.D.	11	14	1,430	0
Sheyenne River near Cooperstown, N.D.	11	123	7,830	0.1
Sheyenne River at West Fargo, N.D.	27	147	2,810	2.0
Maple River at Mapleton, N.D.	12	51.4	4,840	0
Buffalo River near Hawley, Minn.	11	71.8	1,590	6.8
Buffalo River near Dilworth, Minn.	21	118	4,530	0
Wild Rice River at Twin Valley, Minn.	33	161	9,200	0.5
Wild Rice River at Hendrum, Minn.	12	215	4,660	0
Red River of the North at Halstad, Minn.	-	-	24,500	5.4
Goose River at Hillsboro, N.D.	18	59.3		
Sand Hill River at Climax, Minn.	6	43.6	3,040	3
Red Lake River at High Landing, Minn.	27	424	3,720	0
Clearwater River at Red Lake Falls, Minn.	29	289	9,310	0
Red River of the North at Grand Forks, N.D.	74	2,315	80,000	2.4

No. and Location of Gaging Station	Years of Record	Average	Maximum	Minimum
Middle River at Argyle, Minn.	5	22.3	1,390	0
Park River at Grafton, N.D.	20	60.3	4,200	0
Red River of the North at Drayton, N.D.	7	3,880	86,500	7.7
North Branch Two Rivers at Lancaster, Minn.	-	-	1,000	0
Pembina River near Walhalla, N.D.	17	228	20,400	0

Stream flows in the Red River system vary widely. Flow is fairly constant in some of the Minnesota tributaries but in other parts of the Basin, high spring runoffs often cause damaging floods. During other seasons, flows are very low and in some tributaries even approach zero. This wide variation has a serious effect on the amount and quality of water available for various purposes and consequently on water uses. A shortage of water during low flow periods has restricted development of the industrial potential of parts of the Basin. Much of the water shortage in the Basin is due to high evaporation and transpiration losses.

III. INTERFERENCE WITH WATER USES

Wastes discharged into the Red River of the North from sources in Minnesota and North Dakota interfere with water uses in both States in the river stretch from the Fargo, North Dakota - Moorhead, Minnesota area to Grand Forks, North Dakota, by causing:

1. Deterioration of water quality so as to endanger the health of boaters, fishermen, and possibly, swimmers, in the stretch from Fargo, North Dakota, to approximately fifty river miles below East Grand Forks, Minnesota. Coliform data was collected in the summer of 1950 and the winter of 1951. The results showed M.P.N. per 100 ml median values exceeding 5,000 at most sampling

stations within the above mentioned stretch during the summer survey and at a majority of the stations during the 1951 winter survey. (See Appendix A for information.) Municipalities on the main stem are primarily responsible for these high coliform counts as is evident from the tables in Appendix A. It should be noted that high stream flows during the surveys tended to minimize pollutional effects.

2. Deterioration of water quality so as to create undesirable conditions for sport fishing. Dissolved oxygen values as low as 0.6 ppm (see Appendix A) have occurred during winter months when ice cover minimized natural stream reaeration. DO values of this magnitude will very detrimentally affect propagation of fish and aquatic organism life and could cause fish kills.

3. Deterioration of water quality so as to possibly prevent the migration into the Red River of the North Watershed of many new industries dependent upon sufficient water of good quality. The economic factor of high costs involved in treating polluted water so as to make it satisfactory for industrial purposes has tended to cause some new industries to locate elsewhere. Specific instances of such cases are not available at the present time.

4. Deterioration of water quality so as to create nuisance conditions and development of taste and odor conditions in municipal water supplies.

IV. ADEQUACY OF TREATMENT MEASURES

The communities of Graceville, Frazee, Wolverton, Callaway, Kelliher, and Stephen in Minnesota and Finley and Grand Forks in North Dakota have existing

primary treatment facilities which require additions. Replacement or enlargement of existing primary treatment plants are needed at Mayville, North Dakota, and Northome, Red Lake Falls, and Lancaster, Minnesota. Septic tank waste treatment devices at the municipalities of Forman, Lidgerwood, McVille, Cooperstown, Wimbledon, and Enderlin, North Dakota, and the Meat Service Co. and Drayton Creamery at Grand Forks and Drayton, North Dakota, respectively, are inadequate. Fargo, North Dakota needs enlargement of its secondary waste treatment facilities.

Although satisfactory progress is being made in completing waste treatment facilities, wide flow variation in the River will necessitate an evaluation of effects of these facilities on stream conditions.

V. ACTION OF OFFICIAL AGENCIES

a. Federal and Federal-State Joint Action

Concern for pollution problems in the Red River of the North has been indicated by the many reports written on the subject. During the period 1938-1941, a joint investigation by the North Dakota State Department of Health and the Minnesota State Board of Health in collaboration with the U. S. Public Health Service resulted in the 1941 report "Red River of the North Research Investigation." Year 1949 saw the publishing of the preliminary report "Water Needs in the Red River of the North for Domestic and Sanitary Purposes" prepared for Region 6, Bureau of Reclamation by the Missouri River Basin Office of the Public Health Service. The latter report defined the benefits to be derived by flow releases from Missouri-Souris development and Sheyenne Reservoir releases to the Sheyenne and Red Rivers.

Results of surveys made in 1950 and 1951 on sources of pollution in the River were published under the title "Missouri-Souris Development Area Water Pollution Investigation." This report was a joint contribution of the States of Minnesota, North Dakota, Wyoming, Montana, South Dakota, and the Public Health Service.

"A Comprehensive Program for Water Pollution Control for the Red River of the North Basin" was developed by the State Water Pollution Control Agencies of Minnesota, North Dakota, and South Dakota, and adopted by the U. S. Department of Health, Education, and Welfare in 1953. The comprehensive program is now in effect and much has already been accomplished toward completion of this program. The program is flexible, not static, and is intended to reflect the needs for the present situation as currently determined.

TABLE NO. 3 - PUBLIC HEALTH SERVICE GRANTS FOR CONSTRUCTION OF WASTE TREATMENT FACILITIES

Municipality	Date Approved	Amount	Estimated Total Cost of Project	Type of Project	Status of Project
Casselton, N.D.	12/8/58	$ 28,417	$ 101,924	Lagoon	Complete
Enderlin, N.D.	4/28/59	14,145	47,152	Lagoon	Under Construction
Fargo, N.D.	5/29/59	450,411	2,390,302	Repl. Add.	Planning
Grafton, N.D.	3/6/57	159,409	674,629	Lagoon	Complete
Grand Forks, N.D.	7/31/59	250,000	1,522,600	Lagoon	Under Construction
Grand Forks, N.D.	4/59	250,000	1,463,096	Ponds	Under Construction
Hankinson, N.D.	7/11/58	16,578	55,262	Lagoon	Complete

Municipality	Date Approved	Amount	Estimated Total Cost of Project	Type of Project	Status of Project
Hillsboro, N.D.	1/20/58	$ 22,924	$ 86,984	Lagoon	Complete
Hunter, N.D.	1/12/59	16,160	343,666	New Plant	Complete
Lidgerwood, N.D.	3/17/59	17,056	59,856	Lagoon	Complete
Park River, N.D.	10/22/58	17,580	58,600	Repl. Add.	Complete
Petersburg, N.D.	4/9/57	10,195	35,949	Lagoon	Complete
St. Thomas, N.D.	2/11/59	13,865	56,217	Lagoon	Complete
Southwest Fargo, N.D.	7/31/57	83,372	468,900	Lagoon	Complete
Wahpeton, N.D.	5/6/58	63,303	211,012	Lagoon	Complete
Walhalla, N.D.	9/22/60	20,100	67,000	Lagoons	Planning
Crookston, Minn.	12/10/57	137,350	680,810	Lagoon	Complete
E. Grand Forks, Minn.	12/6/57	250,000	1,294,713	Lagoon	Complete
Fergus Falls, Minn.	12/4/58	157,500	532,442	Repl. Add.	Under Construction

b. State Action

To further aid pollution control on the main stem of the Red River of the North, the Departments of Health in the States of North Dakota, South Dakota, and Minnesota; the North Dakota Water Conservation Commission; the Minnesota Department of Conservation; and the South Dakota agency concerned with water conservation formed an informal Red River Drainage Basin Interstate Sanitation Committee in 1944.

Since 1952, the Minnesota Water Pollution Control Commission has conducted a water quality sampling program for critical rivers and lakes. A compilation of sampling station

records from 1953-57 has been published, and the 1957 results referring to Red River of the North stations are reproduced in Appendix A.

It should be mentioned at this point that the two principal contributors to interstate pollution on the Red River of the North, namely Fargo and Grand Forks in North Dakota, are currently planning or constructing adequate waste treatment plants (see Table No. 3). Possible increase in stream flows in the River from return irrigation waters originating in other watersheds will also be of benefit from the standpoint of pollution prevention.

Many of the municipalities listed in the 1953 comprehensive program as needing waste treatment facility improvements have complied with these recommendations. They are: Blackduck, Breckenridge, Crookston, East Grand Forks, Hallock, and Warren, Minnesota; Casselton, Cavalier, Enderlin, Grand Forks, Hankinson, Hillsboro, Lidgerwood, and Park River, North Dakota; and Veblen, South Dakota.

Although notable progress is being made in alleviating the pollution problem in the Red River Basin, a few municipalities and industries have not taken the necessary action and have not made progress in installation of waste treatment works. However, these are not located within the river stretch from Fargo, North Dakota to fifty miles below East Grand Forks, Minnesota.

Plans are being prepared for a waste retention pond at the American Crystal Sugar Company plant at East Grand Forks, Minnesota, and completion is expected by Fall, 1961.

VI. NATURE OF DELAYS IN ABATING POLLUTION

Not known.

VII. TIME SCHEDULE FOR PROPOSED REMEDIAL ACTION

None.

Prepared and approved by Region VI, Kansas City — March 1, 1961

Approved by Enforcement Branch — March 8, 1961

APPENDIX A

Laboratory Data

LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling point	Mileage from Mouth*	Date	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-Day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.	Alkal. p.p.m.	
Station A Red River Bridge in city of Fosston, Minn.	Red R - 2.6 Pa. R. - 0.1	9:05 A 8/21/50	150	15	8.9	88	1.6	-	8.4	230		
	"	9:14 A 8/22/50	145	16	8.7	87	0.5	680	8.2	230		
	"	9:35 A 8/23/50	140	15	8.7	86	1.3	7,000	8.1	220		
	"	1/9/51	45	0	5.3	36	0.7	1,300	7.6	<25	380	
	"	1/10/51	45	0	4.8	33	1.3	2,300	7.4	<25	400	
	"	1/11/51	45	0	5.1	35	2.8	450	7.3	<25	388	
Station 1 Red River Highway bridge at Fisher, Minn.	Red R - 3.0	9:30 A 8/21/50	3,580	17	8.1	83	0.2	-	8.3	320		
	"	9:34 A 8/22/50	3,380	18	8.0	84	0.1	1,100	8.2	360		
	"	9:55 A 8/23/50	3,230	17	8.0	82	0.4	3,300	8.3	270		
	"	1/9/51	2,080	0	9.4	64	0.9	450	7.8	<25	220	
	"	1/10/51	2,080	0	9.6	66	2.2	680	7.7	<25	228	
	"	1/11/51	2,080	0	9.7	66	4.1	230	7.6	<25	216	
Station B Two Rivers Bridge on River Road 9 miles south of Kimball, Minn.	Red R - 20 Two R - 6.2	9:05 A 8/21/50	35	15	8.6	85	1.0	-	8.4	140		
	"	10:11 A 8/22/50	34	16	8.2	82	0.7	1,700	8.2	150		
	"	10:30 A 8/23/50	33	15	8.5	84	1.9	3,300	8.2	150		
	"	1/9/51	8.7									
	"	1/10/51	8.7	0	4.0	27	2.5	2,200	7.4	160	456	
	"	1/11/51	8.7	0	4.2	29	3.0	3,300	7.5	75	388	
Station 2 Red River Highway bridge [illegible]	Red R - 53	11:05 A 8/21/50	2,640	18	7.8	82	0.1	-	8.3	210		
	"	11:08 A 8/22/50	2,760	19	7.7	82	0.4	1,100	8.2	200		
	"	11:28 A 8/23/50	2,620	18	7.9	83	0.8	13,000	8.2	200		
	"	9:58 A 8/24/50	2,520	17	7.8	80	0.6	7,900	8.2	200		
	"	1/9/51	1,990	0	10.2	70	0.7	1,300	7.8	<25	220	
	"	1/10/51	1,990	0	10.3	70	2.6	13,000	7.5	<25	228	
	"	1/11/51	1,990	0	10.2	70	2.5	1,300	7.7	<25	110	
Station C Clear Lake Bridge on River Road 5 miles south of Robin, Minn.	Red R - 65 Pa. R. - 2.0	12:14 P 8/21/50	-	16	8.8	88	3.5	-	8.4	240		
	"	12:12 P 8/22/50	-	19	9.3	99	3.1	1,100	8.3	160		
	"	12:18 P 8/23/50	-	18	9.1	95	3.8	3,300	8.0	170		
	"	10:31 A 8/24/50	-	14	8.0	77	3.0	3,300	8.1	160		
Station D Lake River Highway [illegible] N.E. of Crookston, Minn.	Red R - 67 Pa. R. - 1.2	8:15 A 8/21/50	2	12	9.1	84	>8.8	-	8.4	230		
	"	8:16 A 8/22/50	2	15	8.8	87	>8.7	1,300	7.8	240		
	"	8:36 A 8/23/50	2	12	10.1	93	>9.3	4,900	8.4	240		
	"	8:55 A 8/24/50	2	13	9.2	87	>8.0	4,900	8.0	220		
[illegible] Red River Bridge on [illegible] 4 miles south of Robin, Minn.	Red R - 75 Pa. R. - 1.2	1:06 P 8/21/50	-	17	11.2	115	6.5	-	8.5	95		
	"	1:46 A 8/22/50	-	19	12.4	131	6.6	200	8.3	110		
	"	8:10 A 8/23/50	-	17	11.0	113	7.1	610	8.4	95		
	"	8:24 A 8/24/50	-	16	9.1	91	6.1	200	8.5	120		
	"	1/10/51	-	0	0.5	3	3.8	1,300	7.5	<25	216	
	"	1/11/51	-	0	0.8	5	2.0	200	7.4	<25	444	

*Main stem mileage upstream from International Boundary.

1950-1951

LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling point	Mileage from Mouth*	Date	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-Day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.	Alkal. p.p.m.	
tion 3		1:01 P										
Red River	Red R. - 77	8/21/50	2,750	19	7.6	93	0.1	-	8.3	210		
Directly east of		12:55 P										
Grafton, N. D.	"	8/22/50	2,650	19	7.6	93	0.4	3,300	8.4	200		
Highway #17		1:00 P										
Crossing	"	8/23/50	2,530	18	7.9	93	0.7	7,900	8.2	190		
		11:25 A										
	"	8/24/50	2,410	17	7.8	90	1.0	7,900	8.4	180		
	"	1/9/51	1,970	0	10.6	72	0.5	7,900	7.6	<25	216	
	"	1/10/51	1,970	0	10.5	72	2.7	11,000	7.7	<25	220	
	"	1/11/51	1,970	0	10.5	72	2.3	24,000	7.4	<25	216	
Station 7		1:05 P										
Forrest River	Red R. - 88 Frt.R.- 1.9	8/21/50	7	20	6.4	70	5.2	-	8.6	160		
Highway #44 crossing		7:46 A										
in North Dakota	"	8/22/50	7	15	6.4	63	5.1	780	8.3	160		
	"	8:10 A										
		8/23/50	7	11	6.2	56	6.2	1,100	8.1	230		
	"	8:24 A										
		8/24/50	7	13	6.2	58	5.5	1,100	7.8	160		
Station 4		1:30 P										
Red River	Red R. - 116	8/21/50	2,680	19	8.0	86	0.1	-	8.2	140		
Highway Bridge		1:35 P										
Oslo, Minn.	"	8/22/50	2,550	19	7.7	82	0.5	24,000	8.0	170		
		1:40 P										
	"	8/23/50	2,430	18	7.9	83	1.2	35,000	8.4	150		
		12:12 P										
	"	8/24/50	2,300	17	7.8	80	1.4	24,000	8.4	170		
	"	1/9/51	1,930	0	11.1	76	1.7	35,000	7.8	<25	212	
	"	1/10/51	1,930	0	11.1	76	2.8	11,000	7.7	<25	224	
	"	1/11/51	1,930	0	12.1	83	1.7	17,000	7.4	<25		
tion 5		2:15 P										
River	Red R. - 129	8/21/50	2,640	19	8.1	87	1.4	-	8.0	150		
iver Bank directly		2:10 P										
east of Kennel, N. D.	"	8/22/50	2,520	19	8.2	88	0.9	11,000	8.1	120		
		2: 19 P										
	"	8/23/50	2,390	18	8.4	88	1.0	92,000	8.1	110		
		1:15 P										
	"	8/24/50	2,280	17	7.8	80	1.4	54,000	8.3	110		
	"	1/9/51	1,920	0	11.2	77	1.2	14,000	7.8	<25	204	
	"	1/10/51	1,920	0	11.7	80	1.8	54,000	7.4	<25	180	
	"	1/11/51	1,920	0	11.6	79	1.5	54,000	7.7	<25	208	
Station 6A		2:41 P										
Red River	Red R. - 138	8/21/50	2,600	19	8.5	91	2.2	-	8.2	120		
River bank 6 miles		2:40 P										
north of Grand Forks,	"	8/22/50	2,480	19	8.3	89	0.9	22,000	8.3	130		
N. D.		2:50 P										
	"	8/23/50	2,340	18	8.6	90	1.4	49,000	7.9	110		
	"	2:02 P										
		8/24/50	2,250	17	8.0	82	2.4	92,000	8.0	120		
Station 6		3:55 P										
Red River	Red R. - 141	8/21/50	2,560	19	7.9	89	2.6	-	8.3	100		
West end of		4:01 P										
Riverside Park Dam	"	8/22/50	2,440	19	7.8	87	1.2	49,000	8.1	95		
In Grand Forks, N. D.		3:55 P										
	"	8/23/50	2,300	18	7.9	87	1.8	11,000	8.2	85		
		4:52 P										
	"	8/24/50	2,220	17	7.9	81	1.8	54,000	8.4	95		
	"	1/9/51	1,900	0	10.0	68	1.8	4,900	7.5	25	214	
	"	1/10/51	1,900	0	12.0	82	0.5	4,900	7.6	<25	208	
	"	1/11/51	1,900	0	11.4	78	2.3	11,000	7.7	<25		
Station 8	Red R. - 143	4:25 P										
[illegible] River	R.R.R. - 0.5	8/21/50	1,790	18	8.1	85	0.2	-	8.3	120		
[illegible] Plant Intake	"	4:28 P										
[illegible] Grand Forks,		8/22/50	1,400	19	8.0	86	0.1	4,900	8.1	120		
Minn.	"	4:16 P										
		8/23/50	1,480	19	7.8	83	0.4	13,000	8.1	140		

*Main stem mileage upstream from International Boundary.

RED RIVER SUB-BASIN

1950-1951

LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling point	Mileage from Mouth*	Date	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.	Alkal. p.p.m.
Station M (Cont'd)	Red R. - 143	3:35 P									
Red Lake River	R.L.R. - 0.5	8/24/50	1,450	18	7.3	77	0.7	7,000	8.1	120	
Water Plant Intake											
East Grand Forks,	"	1/9/51	1,660	0	11.4	78	4.5	4,900	7.5	<25	176
Minn.	"	1/10/51	1,720	0	12.5	85	1.3	7,900	7.6	<25	180
	"	1/11/51	1,660	0	12.6	86	2.7	7,000	7.8	<25	
Station 7		4:05 P									
Red River	Red R.-145.7	8/21/50	1,050	19	7.8	83	1.2	-	8.4	95	
Water Plant Intake		3:30 P									
Grand Forks, N. D.	"	8/22/50	1,000	18	6.8	71	4.5	1,800	8.3	100	
	"	3:30 P 8/23/50	950	18	6.6	69	1.4	2,000	8.4	95	
	"	3:00 P 8/24/50	900	16	7.9	79	1.2	2,300	8.4	100	
	"	1/9/51	500	0	0.1	0.7	4.0	780	7.6	35	330
	"	1/10/51	500	0	0.1	0.7	3.3	1,300	7.7	<25	344
	"	1/11/51	500	0	0.1	0.7	2.4	1,100	7.6	<25	360
Station 8		3:05 P									
Red River	Red R. - 180	8/21/50	1,000	18	7.7	80	1.9	-	8.2	320	
Highway #81 Bridge		2:25 P									
Oslo, Minn.	"	8/22/50	950	19	8.0	86	2.8	6,800	8.3	290	
	"	2:30 P 8/23/50	900	18	7.2	75	2.4	7,800	8.4	290	
	"	2:10 P 8/24/50	850	16	7.9	79	2.4	4,900	8.3	260	
	"	1/9/51	450	0	1.4	10	1.9	2,300	7.5	<25	328
	"	1/10/51	450	0	1.6	11	1.9	1,700	7.5	<25	352
	"	1/11/51	450	0	1.4	10	1.9	7,900	7.5	<25	352
Station 8A	Red R. - 202	2:15 P									
North River	No.R. - 2.8	8/21/50	92	16	8.7	87	1.0	-	8.2	100	
Highway #81 Crossing		1:50 P									
Thief River, Minn.	"	8/22/50	81	17	8.6	86	1.0	2,000	8.3	120	
	"	1:55 P 8/23/50	85	17	8.5	87	1.2	2,000	8.3	100	
	"	1:30 P 8/24/50	86	15	8.2	81	6.9	1,300	8.4	120	
	"	1/9/51	60	0	5.0	34	2.1	3,300	7.5	<25	340
	"	1/10/51	64	0	6.2	42	1.3	2,300	7.4	<25	336
	"	1/11/51	62	0	5.6	38	2.2	3,300	7.6	<25	340
Station 1	Red R. - 203	2:40 P									
Goose River	G.R. - 22.0	8/21/50	8	17	11.5	118	3.0	-	8.4	80	
Highway #1A Crossing		2:30 P									
Hillsboro, N. D.	"	8/22/50	8	18	10.1	106	3.8	2,000	8.3	75	
	"	2:15 P 8/23/50	7	19	11.8	126	4.2	680	8.4	70	
	"	1:40 P 8/24/50	9	15	10.1	100	4.0	2,300	8.4	80	
	"	1/9/51	6.7	0	5.4	37	1.4	3,300	7.4	<25	488
	"	1/10/51	6.7	0	5.3	36	1.9	1,400	7.4	<25	464
	"	1/11/51	6.7	0	5.5	38	2.1	22,000	7.3	<25	488
Station 9		1:25 P									
Red River	Red R.- 220.4	8/21/50	900	18	7.7	81	3.2	-	8.3	250	
Highway #75		1:25 P									
Wahpeton, N. Dak.	"	8/22/50	850	19	7.6	81	2.8	4,500	8.4	290	
	"	1:15 P 8/23/50	800	18	7.4	78	2.8	4,900	8.4	330	
	"	1:05 P 8/24/50	750	16	7.8	78	1.4	1,300	8.3	260	
	"	1/9/51	340	0	0.6	4	1.4	2,300	7.6	<25	328
	"	1/10/51	340	0	1.2	8	2.0	1,100	7.5	<25	340
	"	1/11/51	340	0	1.6	11	2.4	780	7.6	<25	344

* Up to and including Goose River from International Boundary.

and Minn. tributaries

1950-1951

LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling point	Mileage from Mouth*	Date	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-Day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml	pH	Turb. p.p.m.	Alkal. p.p.m.	
Station J Minnesota	Red R. - 225 Wild Rice R. - 1.0	1:25 P 8/21/50	3.8	16	8.6	86	0.7	-	8.3	40		
Wild Rice River Highway #81 Crossing	"	1:05 P 8/22/50	3.0	18	9.1	95	0.8	2,000	8.4	40		
	"	1:35 P 8/23/50	2.2	15	8.2	81	0.6	2,000	8.4	30		
	"	1:25 P 8/24/50	5.0	14	8.3	80	1.2	4,900	8.4	35		
Station K 2nd River	Red R. - 261.4	12:45 P 8/21/50	700	18	8.0	84	4.1	-	8.4	260		
Highway Bridge Georgetown, Minn.	"	11:55 A 8/22/50	650	18	8.0	84	3.2	11,000	8.4	310		
	"	11:55 A 8/23/50	600	16	6.4	67	3.8	33,000	8.4	280		
	"	11:45 A 8/24/50	550	16	6.6	66	5.7	92,000	8.4	270		
	"	1/9/51	250	0	3.2	22	1.1	4,600	7.6	<25	348	
	"	1/10/51	250	0	3.4	23	1.2	3,300	7.3	<25	344	
	"	1/11/51	250	0	3.6	25	2.9	4,900	7.4	<25		
Station K Buffalo River	Red R. - 262.2 Buf. R. - 2.0	1:55 P 8/23/50	11	14	9.2	89	0.4	-	8.4	35		
2 miles north of Georgetown, Minn.	"	1:05 P 8/22/50	12	16	8.4	84	1.0	2,000	8.4	55		
	"	12:05 P 8/23/50	9	14	8.6	83	3.8	2,000	8.2	55		
	"	8/24/50	9	14	7.9	76	1.8	2,300	8.3	80		
	"	1/9/51	16	0	0.6	4	1.4	200	7.6	<25	380	
	"	1/10/51	15	0	1.2	8	1.2	180	7.5	<25	392	
	"	1/11/51	15	0	0.3	2	1.6	230	7.5	<25	380	
Station L Red Lake River	Red R. - 273 Shy. R. - 11.0	12:30 P 8/21/50	125	16	9.4	94	2.6	-	8.5	65		
Highway #1 crossing north of Norwood, Minn.	"	11:40 A 8/22/50	120	17	9.8	101	3.0	2,000	8.4	95		
	"	11:35 A 8/23/50	115	16	9.4	94	3.0	4,500	8.4	110		
	"	8/24/50	110	15	7.6	75	6.4	7,900	8.4	140		
	"	1/9/51	54	0	5.9	40	1.4	3,300	7.6	<25	404	
	"	1/10/51	53	0	6.1	42	1.1	7,900	7.6	<25	408	
	"	1/11/51	54	0	6.0	41	2.2	11,000	7.6	<25	408	
Station M [illegible]	Red R. - 2[illegible]	[illegible] 8/21/50	330	18	7.1	74	4.1	-	8.4	160		
[illegible] Road crossing [illegible]	"	[illegible] 8/22/50	330	19	7.1	76	5.2	130,000	8.3	180		
[illegible], N.D. Sewage Plant	"	[illegible] 8/23/50	330	19	7.0	75	5.2	920,000	8.6	180		
	"	[illegible] 8/24/50	329	17	5.6	57	5.8	350,000	8.1	160		
	"	1/9/51	175	0	6.9	47	4.9	54,000	7.6	<25	296	
	"	1/10/51	135	0	7.4	51	6.8	160,000	7.6	<25	296	
	"	1/11/51	175	0	8.2	55	5.0	54,000	7.6	<25	300	
Station N [illegible]	Red R. - 2[illegible]	[illegible] 8/21/50	333	18	8.7	91	3.8	-	8.4	120		
[illegible] Water Plant [illegible], N.D.	"	[illegible] 8/22/50	333	18	9.1	95	3.6	450	8.4	160		
	"	[illegible] 8/23/50	333	18	9.7	102	4.1	450	8.2	110		
	"	[illegible] 8/24/50	267	17	8.2	84	3.4	200	8.4	120		
	"	1/9/51	130	0	10.4	71	0.6	450	7.4	<25	300	
	"	1/10/51	130	0	10.8	74	1.6	200	7.7	<25	292	
	"	1/11/51	130	0	10.9	75	2.1	680	7.5	<25	300	

*Miles upstream mileage upstream from International Boundary.

RED RIVER SUB-BASIN

LABORATORY DATA

SEASONAL AVERAGES

Sampling point	Mileage from Mouth*	Date 1950-51	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.	Alkal. p.p.m.	
Station 12	Red R - 298											
Summer Average			312	18	8.9	93	3.7	450	8.4	130		
Winter Average			130	0	10.7	73	1.4	450	7.9	< 25	237	

*Main st m mileage upstream from International Boundary.

**Median value.

RED RIVER MUD-BASIN

1938-1939

LABORATORY DATA

SUMMARY OF AVERAGE RESULTS

Sampling point	Mileage from Mouth*	Date 1938-39	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-Day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.		
Station 1	Red R. - 3	12/1/38 to 4/1/39	226	0.0	0.38	2.6	5.0	4,200	7.6	16		
Red River		4/1/39 to 7/1/39	1,839	12.4	8.77	81.2	3.9	1,800	8.2	260		
Hwy. bridge at Perbina, N.Dak.		8/1/39 to 10/1/39	209	17.5	8.7	90.7	3.0	200	8.6	105		
Station 2	Red R. - 53	12/1/38 to 4/1/39	240	0.0	0.45	3.1	5.1	5,900	7.6	15		
Red River		4/1/39 to 7/1/39	1,810	13.0	9.21	87.6	1.6	600	8.1	190		
Hwy. bridge at Drayton, N.Dak.		8/1/39 to 10/1/39	184	17.5	7.6	78.8	3.0	350	8.4	113		
Station 3	Red R. - 77	12/1/38 to 4/1/39	660	0.0	0.72	4.9	5.2	4,100	7.6	14		
Red River		4/1/39 to 7/1/39	1,708	13.3	9.2	87.7	4.2	1,200	8.2	162		
Hwy. #17 crossing E. of Grafton, N.D.		8/1/39 to 10/1/39	180	17.5	7.9	82.0	2.2	250	8.4	75		
Station 4	Red R. - 116	12/1/38 to 4/1/39	252	0.0	1.9	13.0	5.6	8,100	7.6	11		
Red River		4/1/39 to 7/1/39	1,606	13.7	7.7	73.0	4.0	27,700	8.0	176		
Hwy. bridge at Oslo, Minn.		8/1/39 to 10/1/39	167	19.0	6.6	70.2	4.2	2,000	8.0	185		
Station 5	Red R. - 129	12/1/38 to 4/1/39	275	0.0	3.8	25.6	5.2	16,600	7.6	11		
Red River		4/1/39 to 7/1/39	1,580	13.7	7.9	72.7	1.4	79,500	8.1	161		
River bank directly E. of Manvel N. Dak.		8/1/39 to 10/1/39	170	18.0	4.35	45.1	3.7	175,000	8.0	121		
Station 6	Red R. - 141	12/1/38 to 4/1/39	280	0.0	4.05	27.7	6.1	14,200	7.7	31		
Red River - above W. end of Riverside Park Dam, Grand Forks, N. Dak.		4/1/39 to 7/1/39	1,575	14.0	7.27	67.0	3.8	26,900	8.1	173		
		8/1/39 to 10/1/39	171	19.8	6.1	65.8	4.2	16,400	8.2	50		
Station H	Red R. - 143 E.L.R. -0.5	12/1/38 to 4/1/39	153	0.0	1.25	22.4	1.4	8,500	7.6	14		
Red Lake River		4/1/39 to 7/1/39	454	14.0	7.47	71.3	2.9	920	8.2	90		
Water plant intake East Grand Forks, Minn.		8/1/39 to 10/1/39	144	19.5	7.7	82.8	4.6	4,300	8.4	43		
Station 7	Red R. -145-7	12/1/38 to 4/1/39	127	0.0	1.25	22.2	2.0	330	7.8	11		
Red River		4/1/39 to 7/1/39	1,091	14.0	8.13	77.2	3.5	960	8.2	158		
Water plant intake Grand Forks, N.D.		8/1/39 to 10/1/39	27	20.5	7.05	77.2	4.0	660	8.4	56		
Station 8	Red R. - 180	12/1/38 to 4/1/39	205	0.0	1.85	12.7	1.7	730	7.6	16		
Red River		4/1/39 to 7/1/39	935	13.7	9.17	85.5	4.3	1,200	8.2	240		
Hwy. bridge W. of Oliver, Minn.		8/1/39 to 10/1/39	29	18.2	7.85	81.0	3.2	4,800	8.4	161		
Station 9	Red R. -220.4	12/1/38 to 4/1/39	248	0.0	2.87	19.7	2.2	2,300	7.7	26		
Red River		4/1/39 to 7/1/39	859	13.3	9.87	92.3	4.2	2,100	8.2	201		
Hwy. bridge at Halstad, Minn.		8/1/39 to 10/1/39	32	18.5	7.4	78.0	1.0	390	8.4	106		
Station J	Red R. - 225 W.R.R. - 1	12/1/38 to 4/1/39	26	0.0	3.5	21.0	1.6	870	7.6	13		
Minn. Wild Rice River		4/1/39 to 7/1/39	185	12.1	9.2	82.2	2.0	1,200	8.2	82		
Hwy. #81 crossing in Minnesota		8/1/39 to 10/1/39	15	19.5	7.4	79.6	1.6	730	8.4	66		

*Main stem mileage upstream from International Boundary.

1938-1939

LABORATORY DATA

SUMMARY OF AVERAGE RESULTS

Sampling point	Mileage from Mouth*	Date 1938-39	Ave. disch. c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5-Day B.O.D. p.p.m.	Coliforms M.P.N. Per 100 ml.	pH	Turb. p.p.m.		
Station 10	Red R. - 261.4	12/1/38 to 4/1/39	282	0.0	4.85	31.2	3.1	14,000	7.6	23		
Red River		4/1/39 to 7/1/39	656	11.0	9.17	84.7	4.4	15,600	8.2	148		
Hwy. bridge at Georgetown, Minn.		8/1/39 to 10/1/39	17	16.5	9.8	103.7	8.0	1,700	8.6	179		
Station K	Red R. - 262.5 Buf. R. - 2	12/1/38 to 4/1/39	45	0.0	0.42	2.9	1.0	1,100	7.5	28		
Buffalo River		4/1/39 to 7/1/39	125	12.3	9.01	82.1	2.5	340	8.2	44		
Hwy bridge 2 mi. N. of Georgetown, Minn.		8/1/39 to 10/1/39	2	17.5	7.7	79.9	2.2	2,100	8.5	65		
Station L	Red R. - 273 Thr.R. - 11	12/1/38 to 4/1/39	32	0.0	5.15	35.2	2.7	7,000	7.6	24		
Thrregne River		4/1/39 to 7/1/39	128	12.1	9.1	83.2	4.6	4,200	8.2	90		
Hwy. rdl crossing N. of Farrcd, N.D.		8/1/39 to 10/1/39	10	18.5	6.75	71.5	4.8	1,800	8.4	85		
Station 11	Red R. - 286	12/1/38 to 4/1/39	242	0.0	8.7	60.2	8.6	84,400	7.8	32		
Red River		4/1/39 to 7/1/39	355	11.6	9.17	85.8	5.2	631,000	8.0	74		
Co. road crossing 2 mi. E. of Fargo, N.Dak. sewage plant		8/1/39 to 10/1/39	11	20.5	3.7	40.9	10.6	852,000	8.2	76		
Station 12	Red R. - 298	12/1/38 to 4/1/39	242	0.2	9.55	65.5	2.4	560	7.7	80		
Red River		4/1/39 to 7/1/39	355	11.8	9.23	86.6	1.8	430	8.2	74		
Water plant intake Fargo, N. Dak.		8/1/39 to 10/1/39	12	21.7	7.65	86.3	5.0	1,000	8.6	34		

*Main stem mileage upstream from International Boundary.

RED RIVER SUB-BASIN

CHEMICAL DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Date	Total Solids	Total Alkalinity	Total Hardness	Iron	Calcium	Magnesium	Sodium	Fluoride	Chloride	Sulfate	Bicarbonate	Carbon Dioxide	pH	Nitrate	MPN per 100 ml
Station 12	7-15-49	198	110	124	3.0	30.8	11.4	0	.07	3.1	4.9	134.5	0		Trace	
Red River - Fargo Water Plant Intake	8-15-49	394	212	292	1.38	48.0	41.8	0	.2	18.0	22.5	258.5		7.9	4.3	
	9-15-50	359.3	214.0	264	1.35	35.2	42.8	0	.15	14.0	0	261.5		8.1	4.4	
	10-14-50	424	230	290	.60	48.0	36.5	7.3	.25	6.5	44.5	281		7.5	Trace	
	11-15-49	441.7	226.4	440.1	.4	75.5	41.0	9.0	.25	8.5	5.6	276.0		7.25	0	
	12-15-49	420.5	242.0	272.1	.3	61.0	28.0	17.5	.25	16.0	Trace	295.5		7.9	0	
	1-12-50	549.8	308.0	225.1	.2	49.0	25.0	50.9	.2	11.0	33.4	376.0		8.2	4.3	1,300
	2-15-50	583.6	280	257.2	.29	57.0	28.0	30.0	.15	22.0	39.1	342.0		7.7	65.0	1,100
	4-11-50	170.2	86.0	118.7	1.2	21.6	13.0	Trace	Trace	0	16.6	105.0		7.1	10.9	79
	5-16-50	331	146	231		45	29	25	0	2	52.3	178	Trace	8.2	Trace	
	6-16-50	438.8	188	320		54.0	45.0	18	0	4.0	88.8	230		8.22	Trace	
	7-17-50	281.0	163	256.8	0.95	32.0	43.0	5.00	.2	1.6		129.0	0	7.4	Trace	
	8-21-50	329.8	199.4	258.3	.72	37.6	40.9	4.0	0	4.0	0	243.5		8.0	Trace	
Station 7	6-20-49	511.0	216.0	280	1.3	56.0	34.1	33.2	.3	19.0	103.8	264.0		8.2	Trace	
Red River Grand Forks	7-20-49	341.0	176.0	205.6	2.5	50.0	22.0	6.05	.3	12.0	34.6	214.2	0		Trace	210
Water Supply Intake	8-20-49	370.0	222.0	270	.78	53.1	33.4	0	.3	12.0	0	271.0		8.2	Trace	79
	10-24-49	486.6	268.0	262	.36	58.2	28.5	34.0	.25	32.0	0	327		7.6	Trace	1,300
	11-22-49	498.0	262.0	285	.4	59.2	33.0	21.0	.25	31.0	33.6	300		8.3	Trace	9,200
	12-27-49	648.8	316.0	333	.26	80.0	30.0	51.0	.2	27.0	72.5	388		7.7	Trace	700
	1-10-50	666.9	334.0	343	.25	80.0	36.0	34.8	.1	26.2	50.2	407		8.0	32.5	490
	2-22-50	584.0	308	257.2	.3	65.0	23.0	34.5	.15	29.6	56.0	351	7.2	8.3	17.4	9,200
	3-22-50	462	266	309	1.3	45	48	23		14	33.5	271	26.4	8.6		220
	4-22-50	318	156	231		45	29	21	0	2	31.5	190	Trace	8.2		79
	5-21-50	139	88	102.5		18	14	0	0	0	0	107		7.7		170
	6-21-50	387	205.8	278	8.8	52	36	36.8	.3	Trace	Trace	251		7.2	2.1	1,800
	7-20-50	342.4	197.6	269.2	2.8	37	43	13.8		4.8	Trace	241	Trace	7.3	Trace	11,000
	8-21-50	499	219.8	431.5	.95	67.5	64.0	28.0	.1	12.0	58.6	268.0		7.9		2,300
	9-21-50	414	230	285	.8	55.0	36	20	.1	5.2	15.8	281.5		8.0		
Station H	6-20-49	360	194	304	1.4	80.0	25	6.7	.29	3.0	117.0	236.0		8.0	Trace	
Red Lake River East Grand Forks Water Plant Intake	7-20-49	475.8	202.0	288.0	1.18	68.8	28.0	17.3	.3	10.0	103.8	246.5		8.1	Trace	54
	8-20-49	342.0	201.0	248	.28	59.0	24.4	0	.3	10.0	0	245.0		8.1		2,400
	9-20-49	344.4	202.0	236	.6	56.0	28.0	Trace	.3	11.0	0	246.5		7.7		640
	10-24-49	305.0	190.0	263.4	.36	46.5	11.5	0	.25	12.0	0	232		7.8		24,000
	11-22-49	350.7	184.0	236.0	.68	57.0	22.9	0	.25	18.0	27.9	224.0		8.15	Trace	24,000
	12-27-49	456.6	214.0	234.6	.35	69.5	14.0	34.5	.2	4.8	72.5	261.0		8.0		9,200
	1-10-50	428.13	204.0	210.5	.25	63.0	13.0	28.4	.25	4.8	56.0	254.0		8.0	8.68	1,800
	2-23-50	351.0	202	319.7	.18	50.0	23.0	0	.15	6.0	27.9	246.0		8.2		2,400
	March	No sample collected														
	4-22-50	220.5	126	214		38	29	0	0	0	0	153.5	0			640
	5-22-50	259.2	164	125.7		33.0	10.5	0	0	0	15.7	200		7.9		1,800
	6-21-50	294.6	169.8	246.0	1.95	55	26.5		.2	4.0	0	207		7.4	Trace	1,800
	7-20-50	293.6	175.8	248.0	1.8	45	33		0	0	0	214		7.0		4,900

WATER QUALITY SAMPLING PROGRAM
Field and Analytical Data
1957

Minnesota River at New Ulm — Station Mi-142

Date	Temp.	pH	Flow** (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta μμ c/l
April 17	48	8.4		780	-	21	12.0	7.8	67
Aug. 7	74	8.0		7,900	-	78	7.5	6.5	280
Sept. 13	63	7.9		2,300	-	54	7.6	3.8	76
Oct. 29	43	8.0		7,900	320	30	9.3	3.8	95
Dec. 3	32	-		3,300	780	13	13.0	3.0	64

Otter Tail River at Breckenridge — Station OT-1

Date	Temp.	pH	Flow* (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta μμ c/l
Jan. 29	33	7.9	139****	450	-	6.0	11.0	3.0	89
April 23	55	8.4	578****	2,200	-	44	10.0	3.9	17.5
June 4	70	8.3	704****	1,700	-	27	8.7	3.1	-
Aug. 1	79	8.0	488****	4,900	-	60	6.9	4.3	390
Oct. 9	48	7.8	**	2,300	260	15	10.0	-	84
Nov. 20	33	8.0	**	400	260	16	12.0	2.5	35

Red River at Grand Forks, North Dakota — Station Re-6

Date	Temp.	pH	Flow (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta μμ c/l
Jan. 30	33	7.3	410****	130,000	-	7.0	9.1	3.6	-
April 24	53	7.9	4050****	33,000	-	500	6.6	7.1	44.0
June 5	66	8.1	2280****	13,000	-	30	8.5	3.3	-
July 31	80	8.0	3580****	70,000	-	78	7.3	3.3	690
Oct. 8	53	7.5	3000****	23,000	370	36	8.5	3.5	230
Nov. 19	33	8.0	3220****	49,000	-	34	12.0	4.5	46

*Gaging Station near Fergus Falls, Minnesota
**Flow readings are not yet available
***Provisional Reading

WATER QUALITY SAMPLING PROGRAM
Field and Analytical Data
1957

Red River at Grand Forks, North Dakota — Station Re-7

Date	Temp.	pH	Flow (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta µµ c/l
Jan. 30	33	7.2	410****	780	-	5.0	10.1	2.8	72.0
April 25	54	8.0	4050****	4,500	-	380	7.0	4.6	49.0
June 5	68	8.0	2280****	1,300	-	38	8.1	3.5	-
July 31	80	8.1	3580****	3,300	-	66	7.2	2.8	907.0
Oct. 8	54	7.6	3000****	450	470	30	7.5	3.3	290.0
Nov. 19	32	8.1	3220****	3,300	550	30	12.0	4.3	96

Red River at Fargo, North Dakota — Station Re-11

Date	Temp.	pH	Flow (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta µµ c/l
Jan. 29	33	8.1	122****	160,000	-	8.0	11.0	3.2	350
April 23	58	7.9	2340****	23,000	-	380	6.7	7.8	80.0
June 4	68	8.1	994****	33,000	-	45	8.4	5.8	-
Aug. 1	80	8.0	648****	350,000	-	96	5.4	6.3	560
Oct. 9	52	7.4	423****	130,000	390	44	5.9	5.3	230
Nov. 20	34	8.3	470****	220,000	410	15	9.9	7.5	52

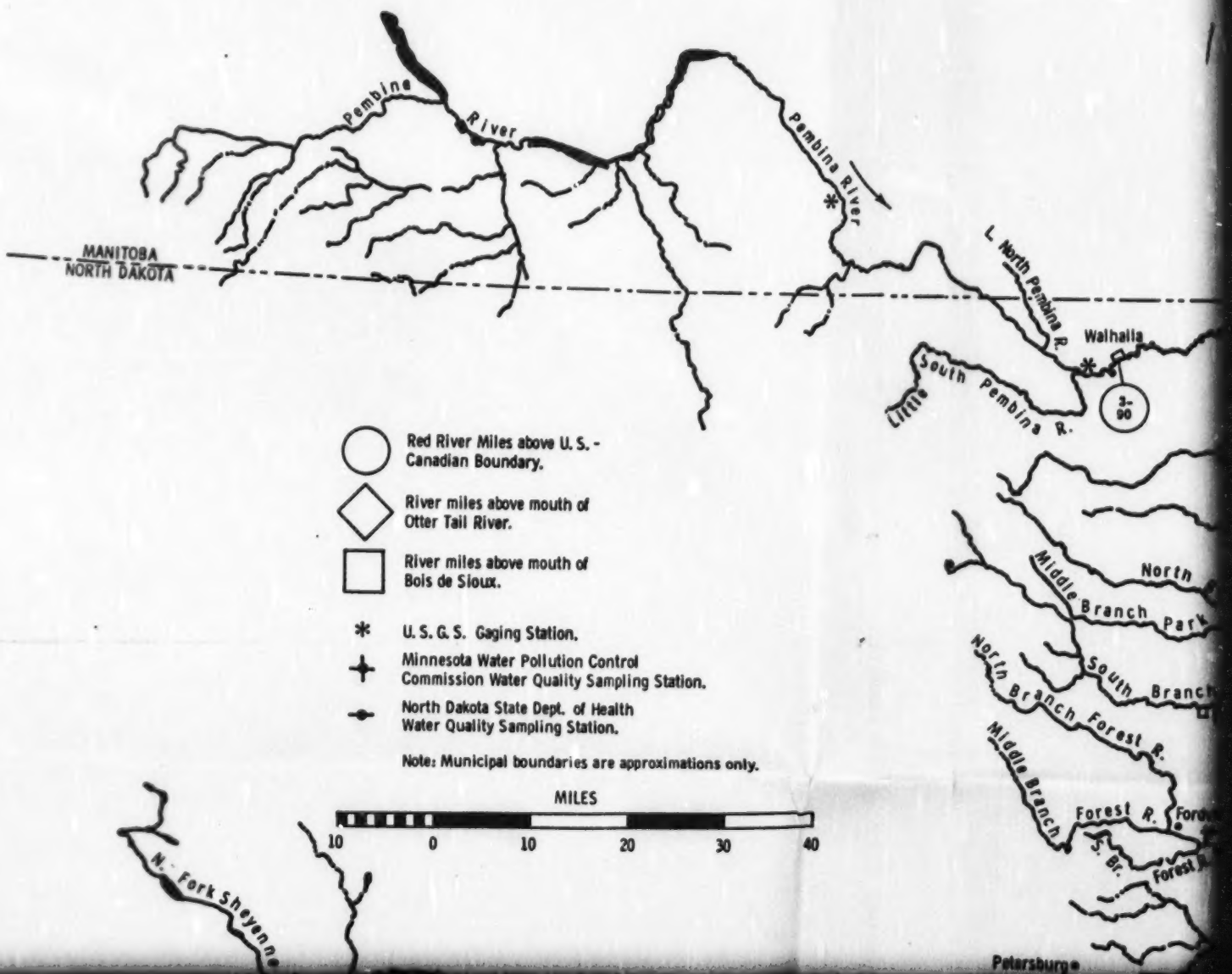
Red River at Fargo, North Dakota — Station Re-12

Date	Temp.	pH	Flow (cfs)	Coliform Group	TS	Turb.	DO	BOD	Radiological Analysis Dissolved Solids Beta µµ c/l
Jan. 29	33	8.0	122	4,900	-	8.0	12.0	2.6	100
April 23	58	8.0	2340	7,900	-	300	7.5	4.8	51
June 4	68	7.9	994	2,300	-	34	9.4	9.1	-
Aug. 1	80	8.0	648	780	-	75	7.5	3.0	400
Oct. 9	52	7.5	423****	680	390	54	7.5	3.0	200
Nov. 20	33	8.2	470****	200	390	12	12.0	3.5	26

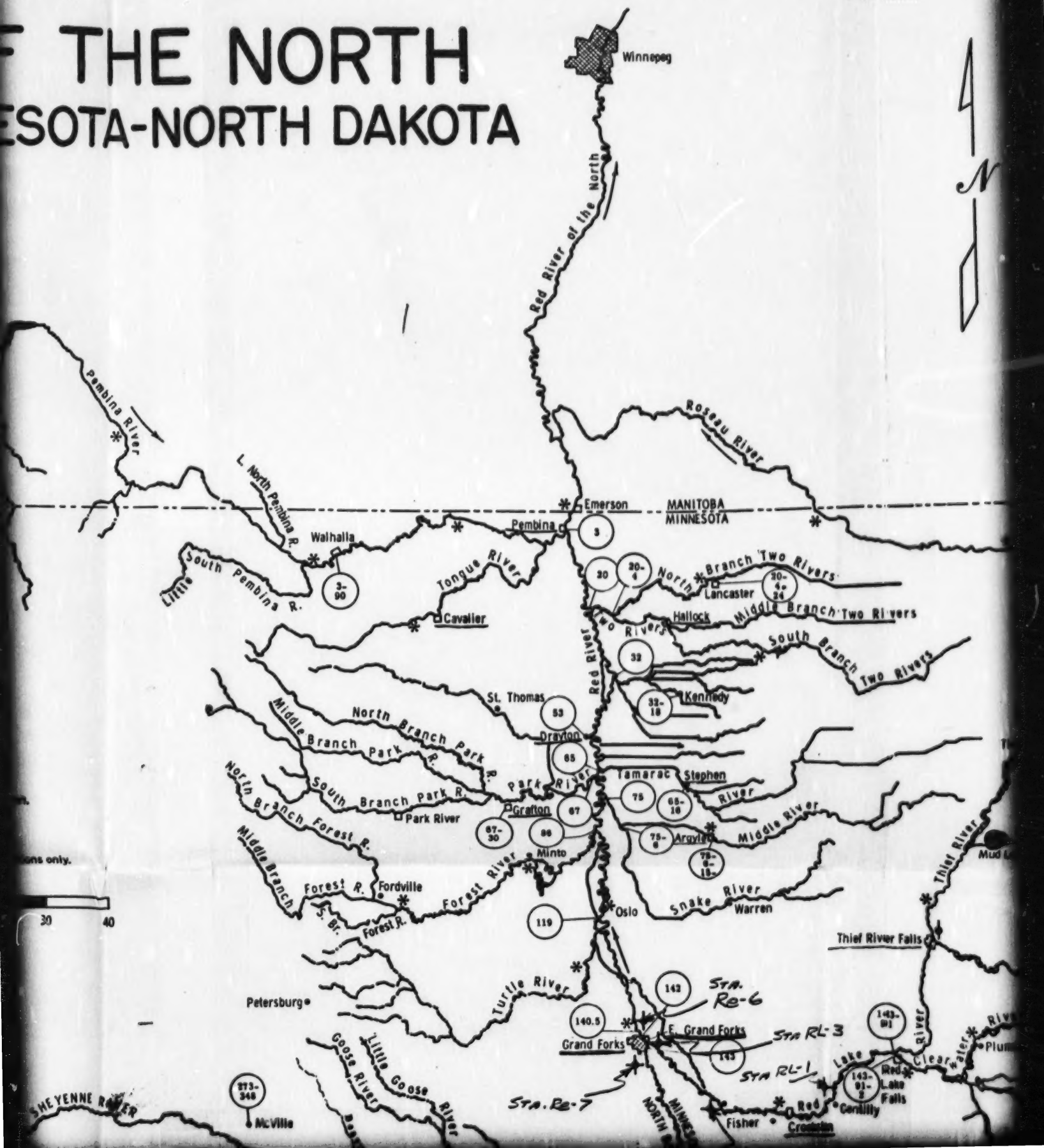
****Provisional Reading

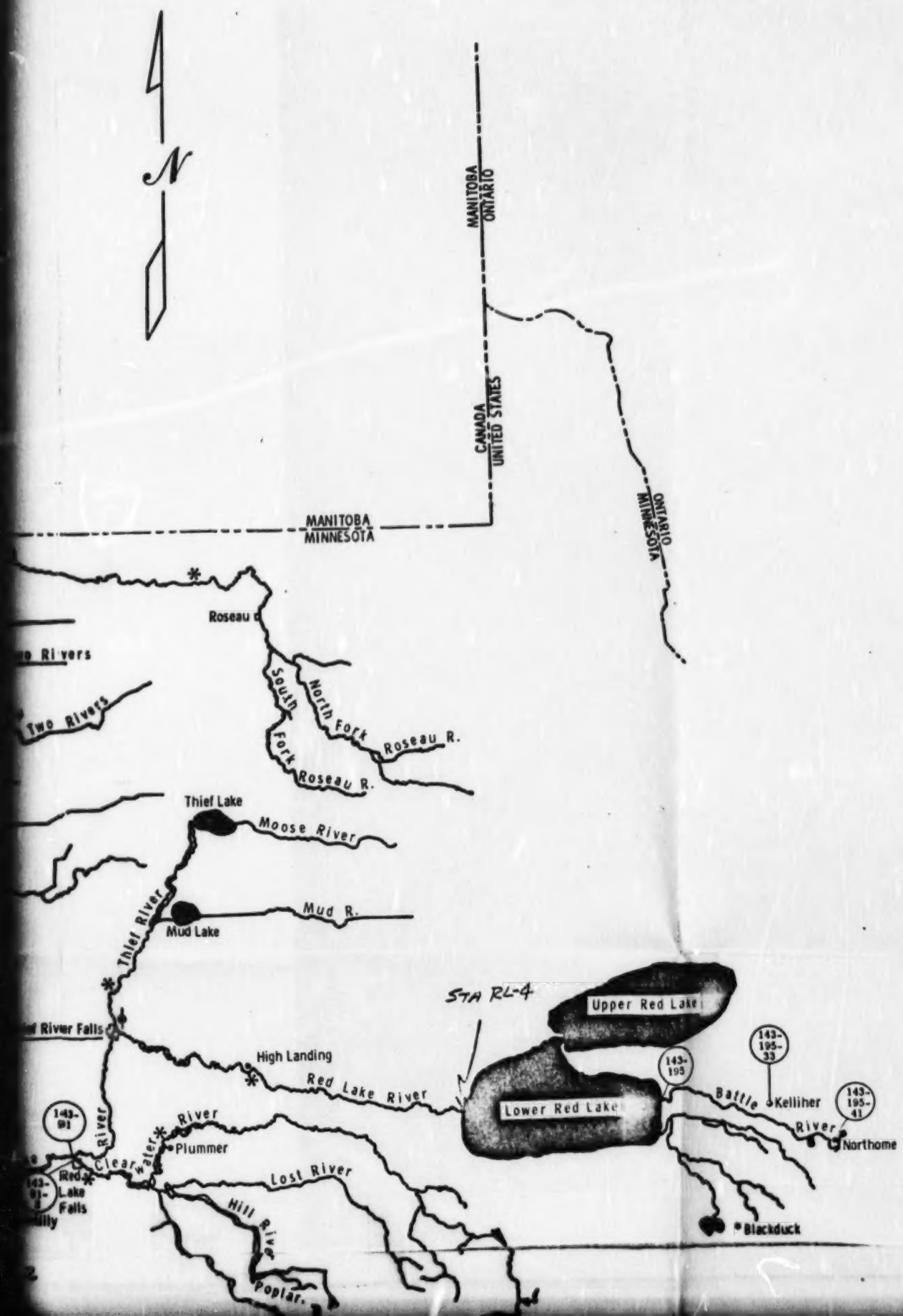
RED RIVER OF THE NORT

SOUTH DAKOTA-MINNESOTA-NORTH DAK


Pembina River
Pembina River
MANITOBA
NORTH DAKOTA
L. North Pembina R.
Walhalla
Little South Pembina R.
3-90
Red River Miles above U. S. - Canadian Boundary.
River miles above mouth of Otter Tail River.
River miles above mouth of Bois de Sioux.
U. S. G. S. Gaging Station.
Minnesota Water Pollution Control Commission Water Quality Sampling Station.
North Dakota State Dept. of Health Water Quality Sampling Station.
Note: Municipal boundaries are approximations only.
MILES
10 0 10 20 30 40
North
Middle Branch
South Branch
North Branch Forest R.
Middle Branch Forest R.
S. Br.
N. Fork Sheyenne
Petersburg

F THE NORTH
ESOTA-NORTH DAKOTA




N
MANITOBA
ONTARIO
CANADA
UNITED STATES
MANITOBA
MINNESOTA
ONTARIO
MINNESOTA
Roseau
Two Rivers
South Fork Roseau R.
North Fork Roseau R.
Thief Lake
Moose River
Mud R.
Mud Lake
Thief River
STA RL-4
Upper Red Lake
Lower Red Lake
High Landing
Red Lake River
143-195
143-195-33
143-195-41
Battle River
Kelliher
Northome
Blackduck
143-91
Clearwater River
Plummer
Red Lake Falls
Lost River
Hill River
Poplar

N. Fork Sheyenne R.
Maddock
273-462
Harvey
SHEYENNE RIVER
273-348
McVille
Br. Forest R.
119
Petersburg
Turtle River
Little Goose River
Goose River
Bartese Cr.
Middle Branch Goose R.
203-60
Finley
203-84-41
203-84-
273-325
Cooperstown
Bald Hill Cr.
SHEYENNE RIVER
S. Br. Goose R.
Elm River
Wimbledon
273-276-29
273-276
Valley City
Maple River
Casselton
Enderlin
273-20-52
SHEYENNE RIV
Lisbon
315-116
Forman
Cayuga
Veblen

Grand Forks
Sta RL-3
Sta RL-1
Sta. Rr-7
Sta RL-2
Lake Clearwater
Plummer
Lost River
Hill River
Poplar River
Red Lake Falls
Gentilly
Fisher
Crookston
Red River
Minnesota
North Dakota
McVille
Goose River
Bygone Cr.
Middle Branch Goose R.
Finley
Mayville
Climax
Sandhill River
Beltrami
Fertile
Shelly
Hillsboro
Halstad
Marsh River
Ada
Mahnomen
Wild Rice River
Twin Valley
Hendrum
Wild Rice
South Br.
Hunter
Elm River
S. Br. Goose R.
Sheyenne River
Cooperstown
Ruff Cr.
South Branch Wild Rice R.
Ogema
Buffalo R.
Callaway
Sta. Rr-11
Buffalo River
Rush Cr.
Casselton
Mapelton
West Fargo
Fargo
Moorhead
Dilworth
South West Fargo
Hawley
Valley City
Maple River
Sta Rr-12
Sabin
Detroit Lakes
Height of Land
Frazee
Otter Tail
Otter Tail Lake
Pelican Rapids
Pelican River
Enderlin
Kindred
Wolverton
Lisbon
Abercrombie
Sta. OT-1
Brushvale
Breckenridge
Wahpeton
Fergus Falls
Otter Tail River
Wild Rice River
Forman
Cayuga
Lidgerwood
Hankinson
Fairmount
Sioux
Minnesota
NORTH DAKOTA
SOUTH DAKOTA
Veblen
White Rock
Mustinka R.
Wheaton
Herman
Ten Mile Cr.
Twelve Mile Cr.
Donnelly
Lake Traverse
West Br. Mustinka R.
Graceville
Sta. Mn 7.5

Lower Red Lake
Battle
Kelliher
143-195-41
River
Northome
Blackduck
Plummer
Clear Water
Lost River
Hill River
Poplar River
Red Lake Falls
143-91-3
Gentilly
Fisher
Crookston
STA RL-1
STA RL-2
Lake
Red
MINNESOTA
DAKOTA
Climax
187-1.5
Sandhill River
Beltrami
Fertile
187-15
187-36
Shelly
Halstad
Marsh River
Ada
220
Hendrum
Wild Rice
Twin Valley
225-60
225-106
Mahnomen
Wild Rice River
Red River
225-21
South Branch Wild Rice R.
225-21-105
Ogema
263
Buffalo R.
STA. RB-11
Buffalo River
Callaway
263-72
Fargo
Moorhead
Dilworth
Hawley
263-43
Height of Land Lake
STA RB-12
292
Sabin
Detroit Lakes
Frazee
Pelican Rapids
46-23
Wolverton
348
Otter Tail
Otter Tail Lake
STA. OT-1
Brushvale
394
Pelican River
Wahpeton
Breckenridge
46
Fergus Falls
Otter Tail River
50
18
Fairmount
SIOUX R.
42-16.6
42-17.2
DAKOTA
DAKOTA
White Rock
River
Mustinka
Herman
Ice Mile Cr.
42-17.2-17
Wheaton
West Br. Mustinka R.
Twelve Mile Cr.
Donnelly
42-16.6-12
42-16.6-12-27
Graceville
STA. MU 7.5
42-16.6-38